eunix: whoami

Eric Bailey

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A reimplementation of `whoami` for my own edification.

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The `main` Function

1b ⟨*Define the* `main` *function.* 1b⟩≡

```
int main(int argc, char *argv[])
{
    ⟨Process given options. 3c⟩

    ⟨Print the user name associated with the current effective user ID. 3e⟩

    return 0;
}
```

This code is used in chunk 1a.
Defines:
`argc`, used in chunk 3c.
`argv`, used in chunk 3c.
`main`, never used.

1a ⟨* 1a⟩≡
⟨*Include headers.* 2a⟩

⟨*Define constants.* 3d⟩

⟨*Forward declarations.* 3a⟩

⟨*Define the* `main` *function.* 1b⟩

⟨*Define the* `usage` *function.* 3b⟩
Root chunk (not used in this document).

Include Headers

Include the core input and output functions from the C standard library.

2a ⟨*Include headers.* 2a⟩≡
```
#include <stdio.h>
```
This definition is continued in chunk 2.
This code is used in chunk 1a.
Defines:
`EOF`, used in chunk 3c.
`printf`, used in chunks 3b and 4d.

From `sys/types.h` import `uid_t`, a data type for user IDs.

2b ⟨*Include headers.* 2a⟩+≡
```
#include <sys/types.h>
```
This code is used in chunk 1a.
Defines:
`uid_t`, used in chunk 3.

From `pwd.h` import the struct, `passwd`, which notably includes the member, `pw_name`, and has a constructor function, `getpwuid`.

2c ⟨*Include headers.* 2a⟩+≡
```
#include <pwd.h>
```
This code is used in chunk 1a.
Defines:
`getpwuid`, used in chunk 4c.
`passwd`, used in chunk 3e.
`pw->pw_name`, used in chunk 4e.

From `unistd.h` import the function, `geteuid`, which returns the effective user ID of the calling process.

2d ⟨*Include headers.* 2a⟩+≡
```
#include <unistd.h>
```
This code is used in chunk 1a.
Defines:
`geteuid`, used in chunk 4a.

Include the GNU `getopt` function from the GNU C Library.

2e ⟨*Include headers.* 2a⟩+≡
```
#include <getopt.h>
```
This code is used in chunk 1a.
Defines:
`getopt`, used in chunk 3c.

"The `getopt` function gets the next option argument from the argument list specified by the `argv` and `argc` arguments. Normally these values come directly from the arguments received by `main`." – GNU, 2017

The `usage` Function

Define the `usage` function, which displays information about how to use `whoami`.

3b ⟨*Define the* `usage` *function.* 3b⟩≡
```
void usage()
{
    printf("Usage: whoami\n");
}
```
This code is used in chunk 1a.
Defines:
`usage`, used in chunk 3.
Uses `printf` 2a.

Processing Options

If any optiosn are given, complain about the first one (via `getopt`), print the `usage` information, and return a nonzero status code.

3c ⟨*Process given options.* 3c⟩≡
```
if (getopt(argc, argv, "") != EOF) {
    usage();
    return 1;
}
```
This code is used in chunk 1b.
Uses `argc` 1b, `argv` 1b, `EOF` 2a, `getopt` 2e, and `usage` 3b.

Printing the Current User's Name

Define a constant, `NO_UID`, to represent the case when `geteuid` returns `-1`, which in `whoami` will signify failureto find the user ID.

3d ⟨*Define constants.* 3d⟩≡
```
uid_t NO_UID = -1;
```
This code is used in chunk 1a.
Defines:
`NO_UID`, used in chunk 4b.
Uses `uid_t` 2b.

Declare the variables `uid`, to store the current user ID, and `pw`, to store further information about the current user.

3e ⟨*Print the user name associated with the current effective user ID.* 3e⟩≡
```
uid_t uid;
struct passwd *pw;
```
This definition is continued in chunk 4.
This code is used in chunk 1b.
Defines:
`pw`, used in chunk 4.
`uid`, used in chunk 4.
Uses `passwd` 2c and `uid_t` 2b.

3a ⟨*Forward declarations.* 3a⟩≡
```
void usage();
```
This code is used in chunk 1a.
Uses `usage` 3b.

Get the effective user ID and store it as `uid`.

4a ⟨*Print the user name associated with the current effective user ID.* 3e⟩+≡
```
uid = geteuid();
```
This code is used in chunk 1b.
Uses `geteuid` 2d and `uid` 3e.

Check whether the effective user ID is `NO_UID`, in which case we won't be able to ⟨*find a user with a matching* `uid` 4c⟩.

4b ⟨*the user ID is* `NO_UID` 4b⟩≡
```
uid == NO_UID
```
This code is used in chunk 4d.
Uses `NO_UID` 3d and `uid` 3e.

Search the user database for an entry with a matching `uid`. If `getpwuid` fails, it returns a null pointer.

4c ⟨*find a user with a matching* `uid` 4c⟩≡
```
pw = getpwuid(uid)
```
This code is used in chunk 4d.
Uses `getpwuid` 2c, `pw` 3e, and `uid` 3e.

If ⟨*the user ID is* `NO_UID` 4b⟩ or we're unable to ⟨*find a user with a matching* `uid` 4c⟩, print a descriptive error message and return a nonzero status code.

4d ⟨*Print the user name associated with the current effective user ID.* 3e⟩+≡
```
if (⟨the user ID is NO_UID 4b⟩ || !(⟨find a user with a matching uid 4c⟩)) {
    printf("Cannot find name for user ID %lu\n",
           (unsigned long int) uid);
    return 1;
}
```
This code is used in chunk 1b.
Uses `printf` 2a and `uid` 3e.

4e ⟨*Print the user name associated with the current effective user ID.* 3e⟩+≡
```
puts(pw->pw_name);
```
This code is used in chunk 1b.
Uses `pw` 3e and `pw->pw_name` 2c.

Full Listing

```c
#include <stdio.h>
#include <sys/types.h>
#include <pwd.h>
#include <unistd.h>
#include <getopt.h>


uid_t NO_UID = -1;


void usage();


int main(int argc, char *argv[])
{
    if (getopt(argc, argv, "") != EOF) {
        usage();
        return 1;
    }

    uid_t uid;
    struct passwd *pw;
    uid = geteuid();

    if (uid == NO_UID || !(pw = getpwuid(uid))) {
        printf("Cannot find name for user ID %lu\n",
               (unsigned long int) uid);
        return 1;
    }
    puts(pw->pw_name);

    return 0;
}


void usage()
{
    printf("Usage: whoami\n");
}
```

Chunks

⟨* 1a⟩ 1a
⟨*Define constants.* 3d⟩ 1a, 3d
⟨*Define the* `main` *function.* 1b⟩ 1a, 1b
⟨*Define the* `usage` *function.* 3b⟩ 1a, 3b
⟨*find a user with a matching* `uid` 4c⟩ 4c, 4d
⟨*Forward declarations.* 3a⟩ 1a, 3a
⟨*Include headers.* 2a⟩ 1a, 2a, 2b, 2c, 2d, 2e
⟨*Print the user name associated with the current effective user ID.* 3e⟩ 1b, 3e, 4a, 4d, 4e
⟨*Process given options.* 3c⟩ 1b, 3c
⟨*the user ID is* `NO_UID` 4b⟩ 4b, 4d

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`argc`: 1b, 3c
`argv`: 1b, 3c
`EOF`: 2a, 3c
`geteuid`: 2d, 4a
`getopt`: 2e, 3c
`getpwuid`: 2c, 4c
`main`: 1b
`NO_UID`: 3d, 4b
`passwd`: 2c, 3e
`printf`: 2a, 3b, 4d
`pw`: 3e, 4c, 4e
`pw->pw_name`: 2c, 4e
`uid`: 3e, 4a, 4b, 4c, 4d
`uid_t`: 2b, 3d, 3e
`usage`: 3a, 3b, 3c

References

GNU. The GNU C Library: Using the getopt function. https://www.gnu.org/software/libc/manual/html_node/Using-Getopt.html, 2017. Accessed: 2017-11-05.